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ABSTRACT

The ability of 20 learning disabled (LD) and 20 non-LD students (mean age of 9 years) to process temporal order information was assessed by employing a relative recency judgment task. Ss were administered lists composed of pictures of everyday objects and were then asked to indicate which item appeared latest on the list (that is, most recently). Non-LD Ss made significantly more correct recency judgment than LD Ss. Objects appearing on different color backgrounds were more easily judged than objects appearing on same color backgrounds. Further, there was an interaction between population and background condition: LD Ss made a smaller number of correct recency judgments than non-LD Ss in the same color background condition. It is concluded that although the ability to encode relative recency information may be an automatic process, the ability to make judgments of relative recency may depend more upon the nature of the events being encoded and the situations in which the judgments are being made. (CL)

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Relative Recency Judgments in Learning Disabled Children: A Semi-Automatic Process

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Introduction

Learning disabled children are children of normal I.Q. who experience problems with academic performance. Typically, learning disabled children manifest disorders in attention, auditory processing, speech, memory, visual processing, reading, spelling, writing, and doing mathematical calculations. Since such a wide variety of disorders have been identified as symptoms of a learning disability, remedial techniques have been difficult to discover and implement. As a result, researchers are forever searching for the most common cause or foremost indicator associated with a learning disability. A review of the research in this area shows that memory deficits are often cited as one of the hallmarks of the learning disabled child. In fact, Vandevoort and Senf (1973) have stated that memory may be the one crucial factor differentiating disabled from nondisabled learners. Children who cannot remember what they have learned in the past, cannot use this knowledge to assist in the assimilation of new information--a variable long believed (Ausubel, 1968) and now determined to be a crucial part of the learning process (Chi, 1978). Since learning disabled children are, by defintion, poor learners; since memory is the pivotal process in the acquisition and maintenance of knowledge; and since the evidence pointing to memory problems in the learning disabled is extensive, the area of memory was chosen for investigation in this study.

Hasher and Zacks (1979) have proposed a framework which attempts to describe the various memory processes that people have available by ordering these processes along a continuum of encoding effort or capacity ranging from automatic to effortful. Automatic processes are

those which drain the least amount of energy from a person's limited capacity attentional mechanism. They are thought to be responsible for the encoding of fundamental aspects of the flow of informaion from the environment; especially spatial, temporal, and frequency of occurrence information. Automatic processes occur without intention, do not benefit from practice, and show limited developmental trends. These are processes for which humans may be genetically prepared. Automatic processes are completed at an early age, largely as a function of maturation, and are supposedly the processes which mediate much of the early learning of the human organism.

Effortful processes drain the largest amount of energy from a person's limited capacity attentional mechanism. These processes are engaged when cognitive strategies are employed to assist in the encoding of information into memory. Examples of these strategies include rehearsal, organization and the use of elaborative and mnemonic devices. Effortful processes require intention to occur and are enhanced by practice. They can be considered the more advanced of the memory phenomena. Young children seldom employ effortful processes, but systematic increases in application and efficency are seen with age.

Research reporting on the learning disabled child's ability to perform memory tasks requiring the use of effortful processing skills has revealed contradictory results. Although some authors have found learning disabled children to be deficient in their use of verbal rehearsal (e.g., Bauer, 1977; Tarver, Hallahan, Kauffman, & Ball, 1976) and organization (e.g., Freston & Drew, 1975; Kosteski, Goldstein, & Hasher, Note 1), others have found little evidence to support this deficiency (e.g., Stein, 1982). However, the research

investigating the learning disabled child's ability to perform automatic processing tasks has revealed consistent findings. Learning disabled children perform as well as nondisabled children in the automatic processing area. Stein (1982) has shown that learning disabled children have no problems recognizing items that have been previously presented in a long list. The ability to recognize that an item has occurred before is considered an automatic process. Also, learning disabled children have been shown to be able to discriminate the frequency of occurrence of items presented 1, 2, 3, and 4 times within a list. The ability to encode and therefore discriminate the frequency of occurrence of events is also considered to be an automatic process.

Although learning disabled children do perform well on some memory tasks in the automatic processing area, there is reason to believe that learning disabled children may not perform well on all tasks falling into this category. Previous research has shown that learning disabled children experiece problems with the processing of temporal order information. According to Hasher and Zacks (1979) the encoding of temporal sequence is an automatic process. Learning disabled children perform poorly on visual and aural memory span tests such as those used by the Wechsler Intelligence Scale for Children (e.g., Dudley-Marling, 1981), the Illinois Test of Psycholinguistic Ability (e.g., Badian, 1977) and the Visual Aural Digit Span Test (e.g., Koppitz, 1981). They show performance deficits on tasks employing dichotic listening (Hynd, Obrzut, Weed, & Hynd, 1979) and on tasks requiring auditory and spatial patterning (e.g., Bauserman & Obrzut, 1981). Since learning disabled children do not show deficits in other automatic processing areas, research confirming a deficiency

employing dichotic listening (Hynd, Obrzut, Weed, & Hynd, 1979) and on tasks requiring auditory and spatial patterning (e.g., Bauserman & Obrzut, 1981). Since learning disabled children do not show deficits in other automatic processing areas, research confirming a deficiency in the ability to encode temporal order information would lead to interesting questions regarding the unique nature of the learning disabled child's learning repertoire.

Procedure

The ability of learning disabled and nondisabled children to process temporal order information was assessed in this study by employing a relative recency judgment task. Brown (1973) and her colleagues (Brown, Campione, & Gilliard, 1974) have shown that the ability to judge the relative recency of events seems to be an innate memory process requiring limited attentional capacity, unaffected by practice, and seemingly devoid of developmental trends. In a relative recency task a person is typically asked to view a long list of items. Within the list each item appears once. After viewing the list, the person is presented with pairs of the previously presented items and is asked to select the "near" item in each pair--the one that has occurred most recently.

Forty children served as subjects in this study. Twenty of the children were diagnosed "learning disabled" and attended a special remedial class within a public school in Erie, Pennsylvania. Twenty of the children were nondisabled and attended regular classes in the same school. The nondisabled children were selected to match the disabled children as closely as possible on chronological age and I.Q. The mean age of the learning disabled group was 9.75 years. The mean

age of the nondisabled group was 9.50 years. The mean I.Q. score of the learning disabled group was 98.4. The mean I.Q. score of the nondisabled group was 101.3.

Each child was tested individually. The child was administered six lists composed of pictures of ordinary objects (e.g., ring, leaf, doll, shoe, etc.). The pictures were presented via a Kodak Carousel slide projecter. Each list was 16 items in length. After each list was presented, three probe cards were shown to the child. Each probe card contained two items from the list (items were in picture form). The child was asked to indicate which item appeared "later on" in the list or "most recently."

Three of the six lists contained items which appeared on the same color background. The remaining lists contained eight items appearing on one color background and eight appearing on another color background. Since the memory for any event consists of a collection of attributes encoded at the time the event is experienced (Underwood, 1971) it was thought that the learning disabled children's ability to make recency judgments might improve if salient background cues were provided. Brown, Campione, & Gilliard, (1974) did find that when background cues could be used to simplify recency judgments, nine- and ten-year-old children could exploit these cues and improve their recall.

Results

The number of correct recency judgments made by each subject in each background color condition (same vs. different) was computed. A

2 (population: learning disabled versus nondisabled) X 2 (background color: same versus different) repeated measures analysis of variance was performed on these recency judgment scores. Nondisabled children made significantly more correct recency judgments than learning disabled children, F (1,37) = 4.68, $p < .05$; however, the difference between the means was quite small. The mean recency judgment score for the learning disabled group was 7.55. The mean for the nondisabled group was 8.10.

Background condition also yielded significant results, F (1,37) = 23.98, $p < .01$. Objects appearing on different color backgrounds (X = 8.33) were more easily judged than objects appearing on same color backgrounds (X = 7.31).

The most interesting result, however, is the presence of a population X background condition interaction, F (1,37) = 5.54, $p < .05$. Learning disabled children made a smaller number of correct recency judgments than nondisabled children in the same color background condition. The means were 6.80 and 7.84 respectively. In the different color background condition the learning disabled children and nondisabled children did not differ in their ability to make recency judgments. The learning disabled group made 8.30 correct recency judgments while the nondisabled group made 8.37.

Conclusions

The results of the present study indicate that learning disabled and nondisabled children both have the ability to process temporal order information. Out of a total number of nine possible correct responses, the learning disabled group achieved a mean of 7.55 and the nondisabled group, a mean of 8.10.

Even though these scores are high and possibly influenced by the presence of a ceiling effect, population differences in performance were evident indicating that this ability is not as well-developed in learning disabled children as in disabled children.

Since the ability to process temporal order information is considered to be an automatic process by Hasher and Zacks (1979), we can add this process to the list of those automatic memory processes which have been found to be intact in learning disabled children. However, unlike recognition memory and the ability to process frequency of occurrence information, there is a difference between the learning disabled and nondisabled child's performance on this task. Although this automatic memory process may be genetically prepared, it may unfold as part of a maturational sequence of abilities and, thus, be prone to a developmental lag in populations which show a slower than normal rate of development. Although there is much controversy about the reason behind the learning disabled child's learning problem, a very popular interpretation is that many of the performance deficits shown in this population result from a lag in the development of the neurological system (e.g., Senf and Feshback, 1970). If this is the case, then the ability to process temporal order may not be an all-or-none phenomenon, but one which relies upon the neural integrity of the central nervous system.

However, even though the above explanation sounds plausible, a problem arises when one considers the fact that the learning disabled children in this study improved their ability to make relative recency judgments when background cues could be used as a strategy to assist memory. According to Hasher and Zacks (1979), if a strategy can be

used to increase recall, then the task is said to engage effortful rather than automatic processes. Although the basic ability to encode temporal order may be related to the functioning of the central nervous system, optimal functioning in particular task situations, especially those which require that a subjective judgment be made, could be related to the criterion used for making such judgments, and thus, to the choice of some implicit or explicit strategy. When events occur farther apart in time, there may be no need to supply a strategy since there are a number of distinct cues that are processed at the time that the event occurs, e.g., place, people inolved, time of day, etc., therefore, the processes may be more automatic (require less effort). However, in experiental task situations, there are usually few distinctive cues. The subject is usually asked to make judgments about items which are very similar in nature; are presented in the same place, by the same person; and which appear very close in time. A situation such as this then, requires that more effort be expended to formulate a criterion for making a correct judgment, and thus, the task becomes one which assesses effortful processes. Since learning disabled children have been shown to improve their performance on memory tasks which supply strategies to assist recall (e.g., Dawson, Hallahan, Reeve, & Ball, 1980; Newman & Hagen, 1981), their improved ability to make recency judgments when background cues are manipulated is not surprising.

In conclusion, it can be said that although the ability to encode relatve recency information may be an automatic process, the ability to make judgments of relative recency may depend more upon the nature of the events being encoded and the situations in which the judgments

are being made. Since the temporal order processing deficits shown by learning disabled children usually occur in task situations which employ the same materials presented at approximately the same point in time (within 15 minutes to an hour), these tasks are really assessing attentional effort more than innate cognitive capability. Researchers attempting to perform investigations in this area should make note of this and adjust their interpretations accordingly.

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